procedures. FCS ACE will provide configuration data about each platform and maintain configuration information throughout the platform's life. This allows the logistics community to generate Interactive Electronic Technical Manuals (IETM) using FCS ACE. As changes are made to FCS platforms in the field, the onboard IETM database will be updated via the FCS reach-back capability.

FCS ACE continues to mature and expand in capability and user base. Today the FCS ACE has more than:

- 3,700 users
- 600 projects
- 1,400 active workflows
- 200 gigabytes of data

FCS ACE provides the backbone of collaboration for the Army, industry and the joint community working together to produce the FCS Future Force UA. The Army has designated FCS ACE as the prototype architecture for Increment I implementation of the Army ACE because it has made such a significant investment in, and seen so much benefit from, FCS ACE. FCS ACE has already made a dramatic impact on the FCS program and will continue to be a critical tool enabling the FCS program to achieve its aggressive timelines and, more importantly, deliver enhanced combat capability to the Soldier.

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Sustainability: An Essential Combat Capability

Nancy A. Moulton

FUTURE COMBAT SYSTEMS FCS One Team-The Army/Defense/Industry

"The FCS Family-of-Systems (FoS) must maximize available combat power while achieving significant logistics footprint reductions and personnel efficiencies in the area of operations (AO) through reduced demand for maintenance and supply." This is the overarching key performance parameter (KPP) for sustainment, as documented in the Future Combat Systems (FCS) Operational Requirements Document (ORD) KPP #5.

The FCS approach to providing sustainment is summarized in the following paragraphs by discussing the four main focus areas for accomplishment that must be addressed during the system development and demonstration (SDD) phase:

- Supportability assessments
- Design for supportability
- Design the support
- Support the design

Supportability Assessments

To meet ORD requirements, three high-level assessment measures are being developed to evaluate operational effectiveness: operational availability, reduced logistics footprint, and lower life-cycle costs for the unit of action (UA). These metrics are supported by many other ORD requirements such as high reliability, increased fuel efficiency, onboard water generation, self-loading and cross-leveling of supplies under armor and a predictive logistics and medical capability. The Program Manager (PM) FCS is using the recently published DOD guide titled

Designing and Assessing Supportability in DOD Weapon Systems: A Guide to Increased Reliability and Reduced Logistics Footprint to develop an integrated approach to assessing UA supportability. An integrated modeling and simulation approach and an integrated test and evaluation methodology are being developed to ensure that a consistent supportability assessment and sustainment evaluation is performed throughout the life cycle.

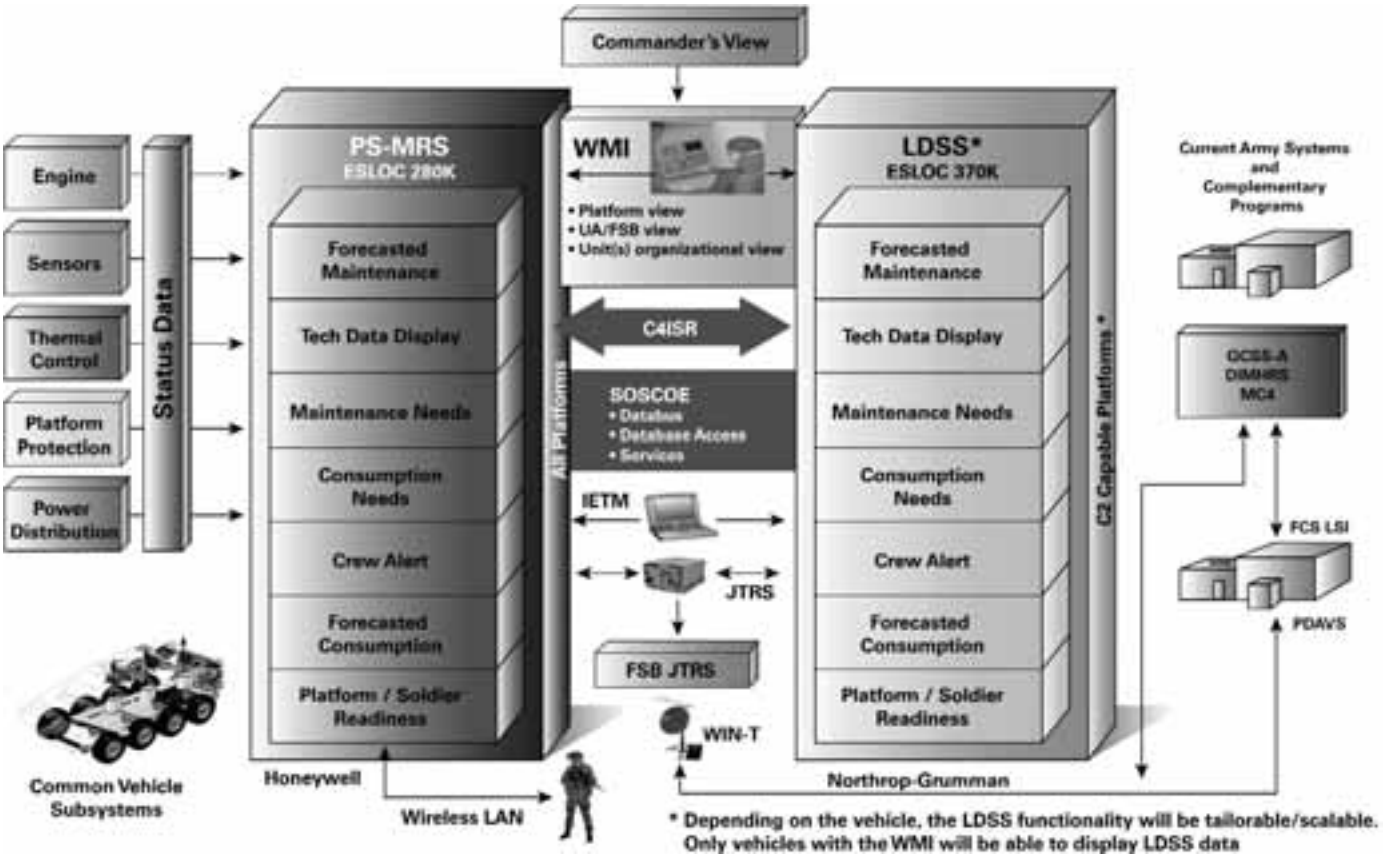
Design for Supportability

To both design supportability into FCS and to incorporate the UA support capability during the SDD phase, logistics design influence is a critical component of the systems engineering and system-of-systems (SoS) integration processes. Logistics contract requirements are structured to achieve SoS optimization at the UA level. These SoS requirements are then allocated to individual system design and, subsequently, to component/subsystem design from individual system requirements. Trade studies are performed that include an assessment of logistics impacts on operational availability, life-cycle costs, logistics footprint and deployability. The intent is for each design decision to optimize the trade between warfighting capability, availability of that capability, performance reliability, logistics footprint, life-cycle costs and affordability, schedule and risk.

> FCS is designing these and other capabilities by using the "pit-stop engineering" approach. Similar to how racing teams design efficiency into their pit stops – Army combat repair teams will be the UA pit crews.

Operational effectiveness measures will be used to ensure availability of systems (to include soldiers) to perform their missions and will be monitored through sensors and software that are integrated into platforms, equipment and the Land Warrior ensemble. Initially, availability will be measured across each battalion-size fleet of like systems. To ensure high operational availability at the SoS level (the collective battalion or brigade-size UA) there are two fundamental components required: maximize uptime and minimize downtime. FCS will maximize uptime by designing in performance characteristics such

FCS Logistics Products — PS-MRS and LDSS



as greater hardware and software reliability, maximizing commonality and increasing fuel efficiency for maximum range between refuel stops. Downtime, when it does occur, will be minimized by designing out most scheduled maintenance, constraining remaining scheduled maintenance to no less than annual time periods, constraining the need for tools and test equipment, maximizing accessibility to components requiring repairs or adjustments and eliminating complicated on-system maintenance procedures. Downtime will also be minimized by designing for two-level maintenance, the capability for the crew to do 80 percent of the on-system maintenance in a much shorter time period and through significant reductions in customer wait times for supplies and parts. FCS is designing these and other capabilities by using the "pit-stop engineering" approach. Similar to how racing teams design efficiency into their pit stops – Army combat repair teams will be the UA pit crews. Equipment will monitor the systems' condition, health and needs and notify the crew and sustainment cell at the Forward Support Battalion (FSB) of support requirements in advance of need. This allows integrated battle management and planning based largely on automatic data feeds from the platforms. Through near-real-time awareness of logistics requirements, the combat commander can plan the maneuver sustainment action into the order of march without degrading the operation.

The FCS FoS must be able to sustain itself with minimal external support. The requirement for platforms to self-load supplies, including ammunition, eliminates the need for stand-alone material handling equipment, extensive manpower requirements and long time delays while reloading. Essentially, this self-loading capability will transform the way we resupply ammunition, missiles and munitions to weapon systems. This one design feature could save billions in operations and support costs over the FCS life cycle.

We must start thinking differently about how combat power will be maintained and sustained. Iron mountains of supplies must be replaced by a lean system of strategically located, mobile and critical items that can be quickly provided where needed based on information obtained from the FCS system-of-systems common operating environment.

Design the Support

The maneuver sustainment concept described in the June 30, 2003, Operational and Organizational Plan demands much from future logistics systems. For example, higher mobility over longer distances drives the future logistics enterprise to become distribution-based versus inventory-based. To enable the transformational maneuver sustainment concept for the UA, the logistics system must also become more predictive than reactive. We must start thinking differently about how combat power will be maintained and sustained. Iron mountains of supplies must be replaced by a lean system of strategically located, mobile and critical items that can be quickly provided where needed based on information obtained from the FCS System-of-Systems Common Operating Environment (SOSCOE). FCS will be able to report supply, personnel and equipment status and predict needs before the shortages occur or before equipment goes down. In the past, an empty fuel tank did not impact the readiness report; in the UA it will. The sustainment services in the SOSCOE include two software products that will enable this new way of doing business in the UA: Platform Soldier-Mission Readiness System (PS-MRS) and the Logistics Decision Support System (LDSS). PS-MRS will feed data from the platform to the LDSS in the FSB and at the national level and provide the interface to and from the Global Combat Support System-Army (GCSS-A) for support outside the UA.

Support the Design

PM FCS is implementing a performance-based logistics (PBL) concept for FCS FoS and the UA. During SDD, the Lead Systems Integrator (LSI) will lead the effort to conduct a business case analysis to develop a best-of-breed PBL implementation plan. This plan will consider the industrial base study, FCS sustaining base study, Army Materiel Command depot and arsenal capabilities, public-private partnerships and best-of-industry practices. One constraint the team will work with is the requirement from the Army Acquisition Executive to not allow routine assignment of any contractors within the UA AO.

The PBL implementation plan will be based on a supply chain plan similar to the support enterprise model used on the Joint Strike Fighter program to validate the plan prior to implementation. Also, selected processes will be tested during the two limited user tests and the final plan will be approved at the initial production decision.

Part of the SOSCOE and logistics products development includes integration kits for complementary programs within the UA. Prototype kits will be developed and tested during SDD. The intent is to have common exportable SOSCOE capability (including logistics) that allows full integration of complementary programs and in lieu of vehicles into the UA maneuver force. Logistics command and control and integration of combat support and combat service support with combat decision making will be included.

During production and fielding, the UA will be fielded with a PBL concept. Performance-based agreements will be developed in conjunction with the user during SDD that state what the PM will deliver to the user in terms of specific metrics that may include performance, availability, reliability, footprint and life-cycle costs. The UA will have a product support integrator (PSI) who will coordinate and manage product support provided by each product support provider (PSP). PSPs will deliver operational availability within the logistical footprint and cost constraints. PSP performance will be measured and incentives awarded for meeting or exceeding goals. The PSI will enforce PSP performance. During SDD, the PSI is the LSI working with PM FCS.

In summary, the Army is transforming the way it designs and supports systems through extensive design influence in the FCS program and through designing systems that will enable embedding logistics functions in the common operating environment in the UA. At the same time, the Army is moving to a performance-based approach to provide product support to the UA. The FCS program has just begun to address the many facets of achieving ORD requirements and will need the help of the entire logistics community to achieve these objectives.

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Training the Future Combat Systems

MAJ Larry S. Anderson and Jeff Simons

The key capability of the Future Combat Systems (FCS) training environment is an unprecedented embedded training (ET) capability inherent to the operational system-of-systems (SoS). This ET is derived from the FCS Mission Needs Statement that states: "Training must be inherent in FCS design to enable units to rapidly deploy without the need for system-specific training and allow individual and collective training on a digital terrain representation of the mission area."

Unprecedented in Army acquisition is the approval of training as a Key Performance Parameter (KPP). This places training equal to other mission-critical capabilities that will enable the FCS Soldier to train and fight like never before. The 2003 FCS Operational Requirements KPP states: "The FCS FoS [Family-of-Systems] must have an embedded individual and collective training capability that supports live, virtual and constructive training environments."

The requirement to host an ET capability as part of the materiel acquisition process for operational systems has been around since the late 1980s, directed by GEN Maxwell R. Thurmond, then the Commander, U.S. Army Training and Doctrine Command (TRADOC), requiring systems be developed with ET inherent to the platforms. However, achieving an ET capability necessitated that the training be developed commensurate with the operational systems. The processing